CLAIMS

1. A tissue biopsy and treatment apparatus for detecting and treating tumors, the apparatus comprising:

an elongated delivery device including a lumen, the elongated delivery device being maneuverable in tissue;

a sensor array deployable from the elongated member, the sensor array including a plurality of resilient members, at least one of the plurality of resilient members being positionable in the elongated delivery device in a compacted state and deployable with curvature into tissue from the elongated delivery device in a deployed state, at least one of the plurality of resilient members including at least one of a sensor, a tissue piercing distal end or a lumen, the sensor array having a geometric configuration adapted to volumetrically sample tissue at a tissue site to differentiate or identify tissue at the tissue site; and

at least one energy delivery device coupled to one of the sensor array, at least one of the plurality of resilient members or the elongated delivery device.

2. The apparatus of claim 1, wherein the plurality of resilient members includes a first, a second resilient member and a third resilient member.

3. The apparatus of claim 1, wherein the geometric configuration defines a sample volume that is substantially hemispherical, spherical ovoid, conical or pyramidal.

4. The apparatus of claim 1, wherein the sensor array is configured to measure a spectral profile of at least one portion of the tissue site.

5. The apparatus of claim 4, wherein the at least one portion includes a first portion and a second portion, the sensor array being configured to substantially simultaneously measure a first spectral profile of the first portion and second spectral profile of the second portion.

6. The apparatus of claim 1, further comprising:

logic resources coupled to one of the sensor array, the sensor, the energy delivery device or a power source coupled to the energy delivery device, the logic resources including a processor, the logic resources configured to identify or differentiate tissue responsive to a signal from one of the sensor or the sensor array.

7. The apparatus of claim 6, wherein the logic resources are configured to distinguish between normal and abnormal tissue, the abnormal tissue including at least one of abnormally mutated tissue, abnormally dividing tissue, cancerous tissue, metastatic tissue, immortal tissue or hypoxic tissue.

8. The apparatus of claim 6, wherein the logic resources are configured to distinguish between at least one of necrosed and non-necrosed tissue, necrosed and non-necrosed healthy tissue or necrosed and non-necrosed abnormal tissue or non-necrosed healthy tissue and necrosed abnormal tissue.

9. The apparatus of claim 6, wherein the logic resources are configured to locate a position of the energy delivery device relative to one of a tumor mass or an ablation volume.

10. The apparatus of claim 9, wherein the logic resources are configured to signal to one of a monitoring device or a display device the position of the energy delivery device relative to the tumor mass or ablation volume.

11. The apparatus of claim 10, wherein the logic resources are configured to graphically display on the display device the position of the energy delivery device relative to the tumor mass or ablation volume.

12. The apparatus of claim 6, wherein the logic resources are configured to identify a clinical endpoint for a tissue ablation procedure of the target tissue volume.

13. A tissue biopsy and treatment apparatus for detecting and treating tumors, the apparatus comprising:

an elongated delivery device including a lumen, the elongated delivery device being maneuverable in tissue;

a sensor array deployable from the elongated member, the sensor array including a plurality of resilient members, at least one of the plurality of resilient members being positionable in the elongated delivery device in a compacted state and deployable with curvature into tissue from the elongated delivery device in a deployed state, at least one of the plurality of resilient members including at least one of a sensor, a tissue piercing distal end or a lumen, the sensor array having a geometric configuration adapted

to volumetrically sample tissue at a tissue site to differentiate or identify tissue at the tissue site;

at least one energy delivery device coupled to one of the sensor array, at least one of the plurality of resilient members or the elongated delivery device; and

logic resources coupled to one of the sensor array, the sensor, the energy delivery device or a power source coupled to the energy delivery device, the logic resources including a processor, the logic resources configured to identify or differentiate tissue responsive to a signal from one of the sensor or the sensor array.

14. A tissue biopsy and treatment apparatus for detecting and treating tumors, the apparatus comprising:

an elongated delivery device including a lumen, the elongated delivery device being maneuverable in tissue;

a sensor array deployable from the elongated member, the sensor array including a plurality of resilient members, at least one of the plurality of resilient members being positionable in the elongated delivery device in a compacted state and deployable with curvature into tissue from the elongated delivery device in a deployed state, at least one of the plurality of resilient members including at least one of a sensor, a tissue piercing distal end or a lumen, the sensor array having a geometric configuration adapted to volumetrically sample and measure a spectral profile of at least one portion of a tissue site to differentiate or identify tissue at the tissue site; and

at least one energy delivery device coupled to one of the sensor array, at least one of the plurality of resilient members or the elongated delivery device.

15. A tissue biopsy and treatment apparatus for detecting and treating tumors, the apparatus comprising:

an elongated delivery device including a lumen, the elongated delivery device being maneuverable in tissue;

a sensor array deployable from the elongated member, the sensor array including a plurality of resilient members, at least one of the plurality of resilient members being positionable in the elongated delivery device in a compacted state and deployable with curvature into tissue from the elongated delivery device in a deployed state, at least one of the plurality of resilient members including at least one of a sensor, a tissue piercing distal end or a lumen, the sensor array having a geometric configuration adapted to substantially simultaneously sample tissue in multiple tissue volumes of a tissue site to differentiate or identify tissue at the tissue site; and

at least one energy delivery device coupled to one of the sensor array, at least one of the plurality of resilient members or the elongated delivery device.

16. A tissue biopsy and treatment apparatus for detecting and treating a tumor, the apparatus comprising:

an elongated delivery device including a lumen, the elongated delivery device being maneuverable in tissue;

a sensor array deployable from the elongated member, the sensor array including a plurality of resilient members, at least one of the plurality of resilient members being positionable in the elongated delivery device in a compacted state and deployable with curvature into tissue from the elongated delivery device in a deployed state, at least one of the plurality of resilient members including at least one of a sensor, a tissue piercing distal end or a lumen, the sensor array having a geometric adapted to volumetrically sample tissue at a tissue site to differentiate or identify tissue

at the tissue site and detect one of a boundary or a volume of a tumor as at least a portion of the sensor array is advanced into the tissue site; and

at least one energy delivery device coupled to one of the sensor array, at least one of the plurality of resilient members or the elongated delivery device.

17. A tissue biopsy and treatment apparatus for detecting and treating tumors, the apparatus comprising:

an elongated delivery device including a lumen, the elongated delivery device being maneuverable in tissue;

a sensor array deployable from the elongated member, the sensor array including a plurality of resilient members, at least one of the plurality of resilient members being positionable in the elongated delivery device in a non deployed state and being deployable from the elongated delivery device into tissue with a changing direction of travel responsive to tissue applied forces, least one of the plurality of resilient members including at least one of a sensor, a tissue piercing distal end or a lumen, the sensor array having a geometric configuration adapted to volumetrically sample at a tissue site to differentiate or identify tissue at the tissue site; and

at least one energy delivery device coupled to one of the sensor array, at least one of the plurality of resilient members or the elongated delivery device.

18. The apparatus of claim 17, wherein the plurality of resilient members includes a first and a second resilient member, the first resilient member having a first direction of travel and the second resilient member having a second direction of travel.

19. The apparatus of claim 17, wherein at least one of the plurality of resilient members has at least one of an elastic modulus, a bending modulus, a taper, a memory or a glass transition temperature sufficient to produce a changing direction of travel in response to a force applied by tissue.

20. A tissue biopsy and treatment apparatus for detecting and treating tumors, the apparatus comprising:

an elongated delivery device including a lumen, the elongated delivery device being maneuverable in tissue;

a sensor array deployable from the elongated member, the sensor array including a plurality of resilient members, at least one of the plurality of resilient members being positionable in the elongated delivery device in a compacted state and deployable with curvature into tissue from the elongated delivery device in a deployed state, at least one of the plurality of resilient members including at least one of a sensor, a tissue piercing distal end or a lumen, the sensor array having a geometric configuration adapted to volumetrically sample tissue at a tissue site to differentiate or identify tissue at the tissue site during an energy delivery interval, a tissue desiccation condition, a tissue charring condition or a tissue vaporization condition; and

at least one energy delivery device coupled to one of the sensor array, at least one of the plurality of resilient members or the elongated delivery device.

21. The apparatus of claim 1, wherein the sensor is positionable within the lumen.

22. The apparatus of claim 1, wherein the sensor comprises one of a light conducting member or an optical fiber positionable within the lumen of the at least one resilient member, the light conducting member or the optical fiber configured to be coupled to a light source or a coherent light source.

23. The apparatus of claim 22, wherein the sensor comprises an emitting optical fiber and a detecting optical fiber positionable within the lumen of the at least one resilient member.

24. The apparatus of claim 1, wherein the plurality of resilient members includes a first resilient member having a first lumen with a first positionable optical sensing member and a second resilient member having a second lumen with a second positionable optical sensing member.

25. The apparatus of claim 24, wherein the first sensing member is a first optical fiber configured as one of an emitter or a detector and the second optical sensing member is a second optical fiber configured as one of an emitter or a detector.

26. The apparatus of claim 25, wherein the plurality of resilient members includes a third resilient member having a third lumen with a third positionable optical fiber configured as one of an emitter or a detector.

27. A tissue biopsy and treatment apparatus for detecting and treating tumors, the apparatus comprising:

an elongated delivery device including a lumen, the elongated delivery device being maneuverable in tissue;

a sensor array deployable from the elongated member, the sensor array including a plurality of resilient members, at least one of the plurality of resilient members being positionable in the elongated delivery device in a compacted state and deployable with curvature into tissue from the elongated delivery device in a deployed state, at least one of the plurality of resilient members being maneuverable in tissue, at least one of the plurality of resilient members including a lumen and an optical sensor member positionable within the lumen; the sensor array having a geometric configuration adapted to volumetrically sample at a tissue site to differentiate or identify tissue at the tissue site; and

at least one energy delivery device coupled to one of the sensor array, at least one of the plurality of resilient members or the elongated delivery device.

28. The apparatus of claim 1, wherein the sensor is configured to detect a change in a tissue property.

29. The apparatus of claim 28, wherein the property includes at least one of a physiologic property, a metabolic property, a thermal property, a temperature, an electrical property, an impedance, an optical property, an absorbance, a reflectance, a dimensional property or a pH.

30. The apparatus of claim 1, wherein the sensor array is configured to detect at least one of a tissue ablation volume, a cell necrosis volume, a tissue thermal volume or a tissue hyperthermic volume.

31. The apparatus of claim 1, wherein the sensor array is configured to detect at an indicator of cell necrosis.

32. The apparatus of claim 31, wherein the indicator of cell necrosis is a tissue vapor bubble, a rate of tissue vapor bubbles formation, a denatured tissue protein, a denatured DNA or an intracellular fluid.

33. The apparatus of claim 31, wherein the sensor includes a first set of sensors configured to detect tumorous tissue and a second set of sensors configured to detect an indicator of cell necrosis.

34. The apparatus of claim 1, wherein the sensor array is configured to distinguish between non cancerous and cancerous tissue.

35. A tissue biopsy and treatment apparatus for detecting and treating tumors, the apparatus comprising:

an elongated delivery device including a lumen, the elongated delivery device being maneuverable in tissue;

a sensor array deployable from the elongated member, the sensor array including a plurality of resilient members, at least one of the plurality of resilient members being positionable in the elongated delivery device in a compacted state and deployable with curvature into tissue from the elongated delivery device in a deployed state, at least one of the plurality of resilient members including at least one of a sensor, a tissue piercing distal end or a lumen, the sensor array configured to volumetrically sample tissue at a tissue site and distinguish between healthy tissue and abnormal tissue at the tissue site; and

at least one energy delivery device coupled to one of the sensor array, at least one of the plurality of resilient members or the elongated delivery device.

36. The apparatus of claim 35, wherein the abnormal tissue includes at least one of abnormally mutated tissue, abnormally dividing tissue, abnormal DNA synthesis tissue, cancerous tissue, metastatic tissue, immortal tissue or hypoxic tissue.

37. The apparatus of claim 1, wherein the sensor array is configured to detect at least one of a tissue ablation volume, a tissue thermal volume tissue hyperthermic volume or a tumor volume.

38. The apparatus of claim 1, wherein the sensor includes a first sensor and a second sensor.

39. The apparatus of claim 38, wherein at least one of the first or second sensors is positioned at a greater distance with respect to a longitudinal axis of the elongated delivery device than the at least one energy delivery device.

40. The apparatus of claim 39, wherein the first sensor comprises a first optical member positionable within a lumen of a first resilient member of the plurality of resilient members and the second sensor is a second optical member positionable within a lumen a second resilient member of the plurality of resilient members.

41. The apparatus of claim 39, wherein the greater distance is at least
one of a radial distance or a longitudinal distance.

42. The apparatus of claim 38, wherein at least one of the first or second sensors is an emitter, an electromagnetic emitter, an optical emitter, an acoustical emitter, a laser or an LED.

43. The apparatus of claim 42, wherein the emitter is substantially positioned within a volume defined by the sensor array.

44. The apparatus of claim 42, wherein the emitter is substantially positioned outside of a volume defined by the sensor array.

45. The apparatus of claim 42, wherein the emitter emits a reference signal and a probe signal.

46. The apparatus of claim 42, wherein the sensor includes a third sensor adapted to detect the reference signal.

47. The apparatus of claim 46, wherein the third sensor is adapted to detect the reference signal with substantially no affect from tissue.

48. The apparatus of claim 47, wherein the third sensor is positioned substantially adjacent or in proximity to the emitter

49. The apparatus of claim 42, wherein the emitter is configured to emit electromagnetic energy over a selectable frequency range.

50. The apparatus of claim 1, further comprising:
at least one infusion port coupled to one of the elongated delivery device or at least one resilient member of the plurality of resilient members.

51. The apparatus of claim 1, wherein the sensor array includes a third and a fourth resilient member.

52. The apparatus of claim 1, wherein the sensor array is configured to detect a marking agent.

53. The apparatus of claim 52, wherein the sensor array is configured to detect an absence of the marking agent.

54. The apparatus of claim 52, wherein the sensor array is configured to obtain one of an improved resolution or an improved sensitivity.

55. The apparatus of claim 52, further comprising a source of marking agent fluidically coupled to one of the elongated delivery device or at least one of the plurality of resilient members.

56. The apparatus of claim 55, wherein the marking agent is one of an optical marker, a fluorescent marker, a radioactive-marker, a temperature sensitive marker, an antibody, a liposome, an antibody-coated liposome, a microsphere or a chemotherapeutic agent.

57. The apparatus of claim 55, wherein the marking agent is reactive to a delivery of energy from at least one of the energy delivery device, the senor or the sensor array.

58. The apparatus of claim 55, wherein the marking agent is configured to enhance at least one of the delivery of energy to a least a

portion of the tumor volume or the degree of thermal injury to the at least a portion of the tumor volume.

59. The apparatus of claim 58, wherein the at least a portion of the tumor volume is a selectable portion.

60. The apparatus of claim 55, wherein the marking agent includes a plurality of marking agents.

61. The apparatus of claim 55, wherein the marking agent is configured to detect one of a gene, a gene fragment, a genetic variant, a genetic mutation, a DNA sequence, a DNA fragment or an expressed sequence tag.

62. The apparatus of claim 60, wherein the plurality of marking agents include a first marking agent configured to mark a first tissue condition or first tissue type and a second marking agent configured to mark a second tissue condition or second tissue type.

63. The apparatus of claim 62, wherein at least one of the first or the second tissue conditions is a cancerous tissue condition.

64. The apparatus of claim 62, wherein at least one of the first or the second tissue conditions is one of a thermal injury condition, a tissue necrosis, a tissue ablation, a tissue vaporization, a tissue coagulation, or a cell membrane rupture.

65. The apparatus of claim 62, wherein the first tissue condition is a cancerous condition and the second tissue condition is a thermal injury condition.

66. The apparatus of claim 62, wherein the first tissue condition is a first tissue temperature and the second condition is a second tissue temperature.

67. The apparatus of claim 66, wherein the second tissue temperature is one of a tissue injuring temperature, a tissue necrosing temperature, a tissue ablative temperature, or a tissue a vaporization temperature.

68. The apparatus of claim 62, wherein the plurality of marking agents includes a third marking agent.

69. The apparatus of claim 60, wherein the plurality of marking agents includes a first marking agent coupled to a marking agent carrier, wherein the marking agent carrier is configured to release the first marking agent at a selectable temperature, tissue condition or tissue chemical concentration.

70. The apparatus of claim 69, wherein the selectable temperature is in the range of about 40° C to about 60° C.

71. The apparatus of claim 69, wherein the selectable temperature is in the range of about 45° C to about 55° C.

72. The apparatus of claim 69, wherein the plurality of marking agents includes a second marking agent coupled to a second marking agent carrier, wherein the second marking agent carrier is configured to release the first marking agent at a second selectable temperature.

73. The apparatus of claim 72, wherein the second selectable temperature is in the range of about 40° C to about 60° C.

74. The apparatus of claim 72, wherein the second selectable temperature is in the range of about 45° C to about 55° C.

75. The apparatus of claim 1, wherein the energy delivery device is at least one of a microwave antenna, a RF electrode, a monopolar RF electrode or a bipolar RF electrode.

76. The apparatus of claim 75, further comprising:
an RF energy source coupled to the RF electrode.

77. The apparatus of claim 1, wherein the energy delivery device comprises at least a portion of one resilient member of the plurality of resilient members or substantially all of the resilient members of the plurality of resilient members.

78. The apparatus of claim 77, wherein the energy delivery device is an RF electrode configured to be coupled to an RF energy source or an RF electrode with an insulation layer over at least a portion of an electrode length, the RF electrode configured to be coupled to an RF energy source.

79. The apparatus of claim 77, further comprising:

a handpiece coupled to one of the elongated delivery device or the sensor array; and

a first advancement device at least partially positionable in one of the handpiece or the elongated member, the advancement device configured to advance at least one of the plurality of resilient members or the sensor.

80. The apparatus of claim 79, further comprising:

a second advancement device at least partially positionable in one of the handpiece or the elongated member, the second advancement device configured to advance at least one of the plurality of resilient members or the sensor independent of an advancement of the first advancement device.

81. A tissue biopsy and treatment apparatus for detecting and treating tumors, the apparatus comprising:

an elongated delivery device including a lumen, the elongated delivery device being maneuverable in tissue;

a sensor array deployable from the elongated member, the sensor array including a plurality of deployable RF electrodes, at least one of the plurality of RF electrodes being positionable in the elongated delivery device in a compacted state and deployable with curvature into tissue from the elongated delivery device in a deployed state, at least one of the plurality of RF electrodes including at least one of a tissue piercing distal end, an electrode lumen or at least one optical sensor member positionable in the electrode lumen; the sensor array having a geometric configuration adapted to volumetrically sample tissue at a tissue site to differentiate or identify tissue at the tissue site;

a handpiece coupled to one of the elongated delivery device or the sensor array; and

a rigid advancement device at least partially positionable in handpiece, the advancement device configured to advance at least one of the plurality of RF electrodes or the at least one optical sensor member.

82. A tissue biopsy and treatment apparatus for detecting and treating a tissue site, the apparatus comprising:

an elongated delivery device means including a lumen means;

a sensor array means including a plurality of resilient member means, at least one of the plurality of resilient member means being positionable in the elongated delivery device means in a compacted state and deployable from the elongated delivery device means with curvature in a deployed state, at least one of the plurality of resilient member means including at least one of a sensor means, a lumen means, or a tissue piercing distal end means, the sensor array means having a geometric configuration adapted to volumetrically sample tissue at a tissue site to differentiate or identify tissue at the tissue site; and

at least one energy delivery device means coupled to one of the sensor array means, at least one of the resilient member means or the elongated delivery device means.